FIG. 1

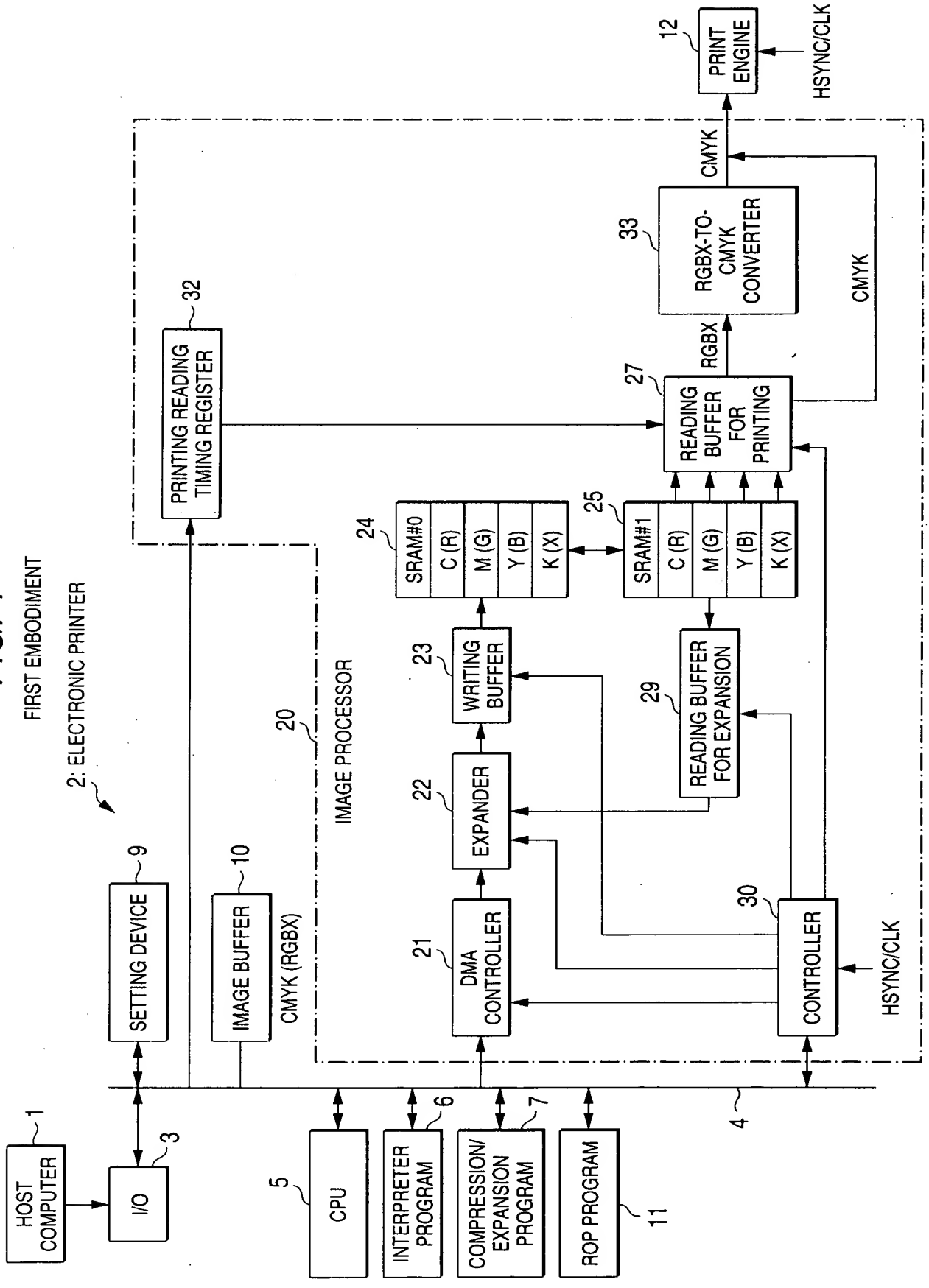

FIRST EMBODIMENT
2: ELECTRONIC PRINTER
HOST COMPUTER
1
I/O
3
SETTING DEVICE
9
IMAGE BUFFER
10
CMYK (RGBX)
20
IMAGE PROCESSOR
PRINTING READING TIMING REGISTER
32
PRINT ENGINE
12
HSYNC/CLK
CMYK
RGBX-TO-CMYK CONVERTER
33
RGBX
READING BUFFER FOR PRINTING
27
SRAM#0
C (R)
M (G)
Y (B)
K (X)
24
SRAM#1
25
WRITING BUFFER
23
READING BUFFER FOR EXPANSION
29
EXPANDER
22
DMA CONTROLLER
21
CONTROLLER
30
HSYNC/CLK
CPU
5
INTERPRETER PROGRAM
6
COMPRESSION/ EXPANSION PROGRAM
7
ROP PROGRAM
11
4

FIG. 2

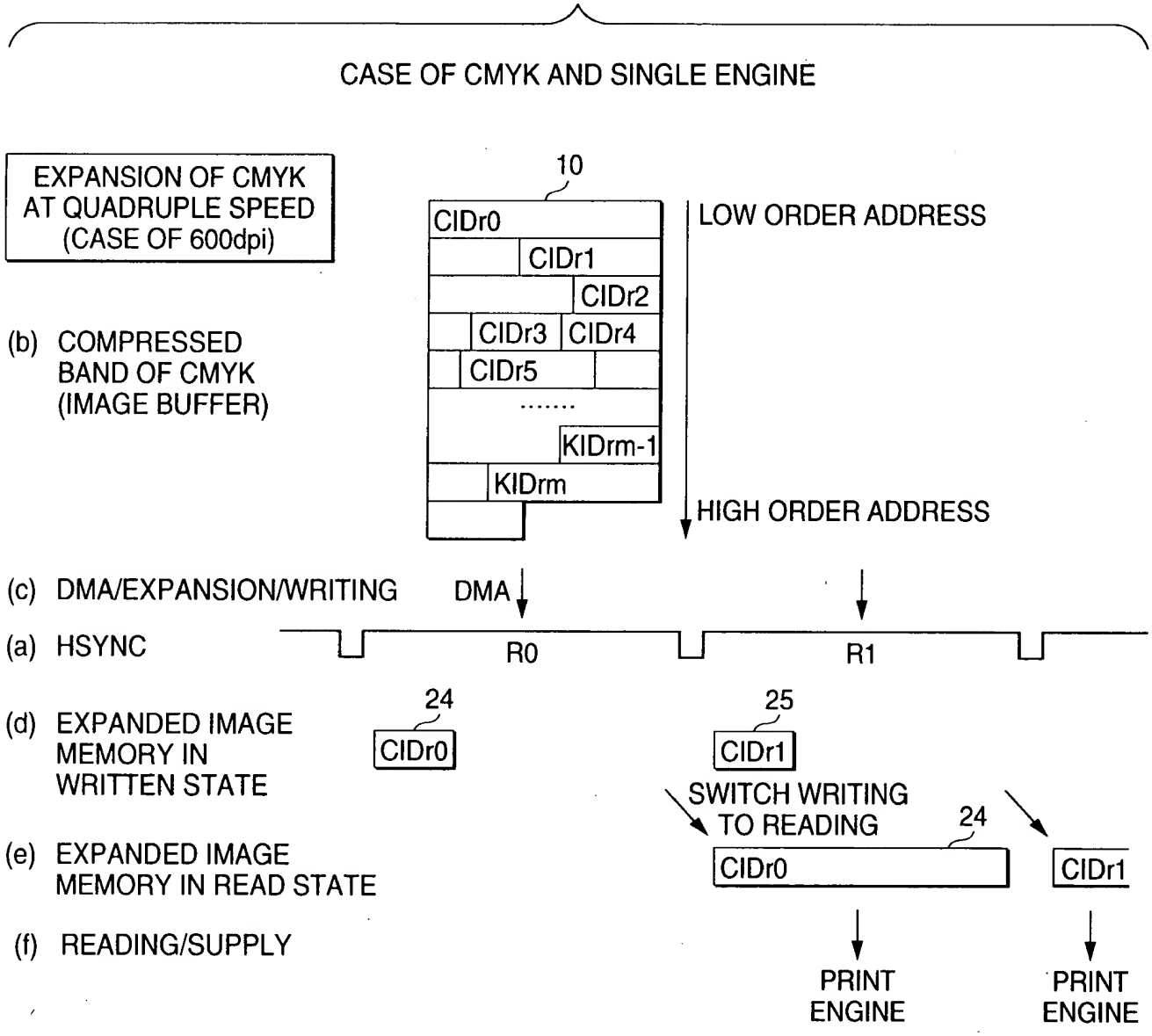

CASE OF CMYK AND SINGLE ENGINE
EXPANSION OF CMYK AT QUADRUPLE SPEED (CASE OF 600dpi)
(b) COMPRESSED BAND OF CMYK (IMAGE BUFFER)
10
CIDr0
CIDr1
CIDr2
CIDr3
CIDr4
CIDr5
.....
KIDrm-1
KIDrm
LOW ORDER ADDRESS
HIGH ORDER ADDRESS
(c) DMA/EXPANSION/WRITING
DMA
(a) HSYNC
R0
R1
(d) EXPANDED IMAGE MEMORY IN WRITTEN STATE
24
CIDr0
25
CIDr1
SWITCH WRITING TO READING
(e) EXPANDED IMAGE MEMORY IN READ STATE
24
CIDr0
CIDr1
(f) READING/SUPPLY
PRINT ENGINE
PRINT ENGINE

FIG. 3

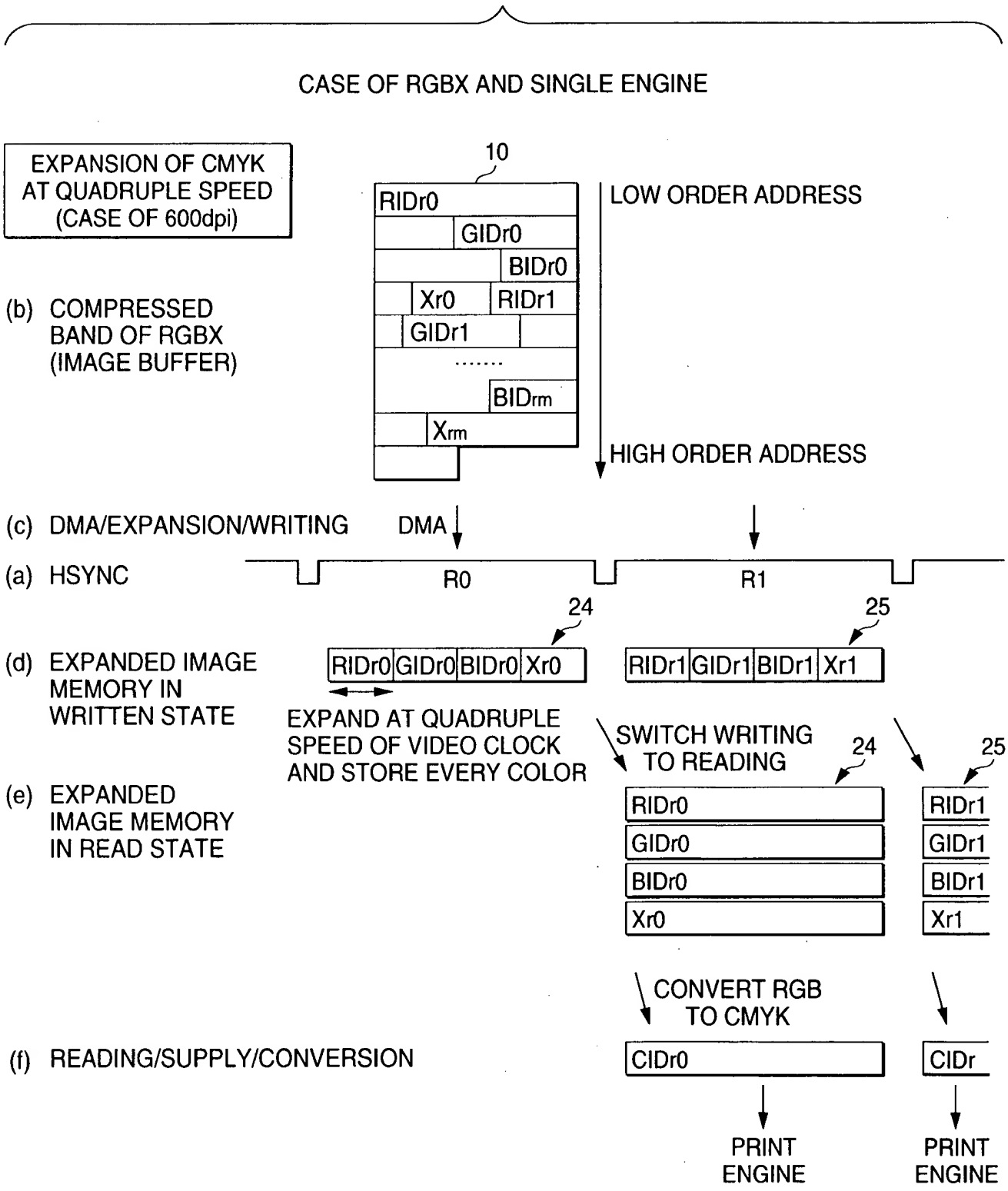

CASE OF RGBX AND SINGLE ENGINE
EXPANSION OF CMYK AT QUADRUPLE SPEED (CASE OF 600dpi)
10
RIDr0
GIDr0
BIDr0
Xr0
RIDr1
GIDr1
.....
BIDrm
Xrm
LOW ORDER ADDRESS
HIGH ORDER ADDRESS
(b) COMPRESSED BAND OF RGBX (IMAGE BUFFER)
(c) DMA/EXPANSION/WRITING
DMA
(a) HSYNC
R0
R1
24
25
(d) EXPANDED IMAGE MEMORY IN WRITTEN STATE
RIDr0 GIDr0 BIDr0 Xr0
RIDr1 GIDr1 BIDr1 Xr1
EXPAND AT QUADRUPLE SPEED OF VIDEO CLOCK AND STORE EVERY COLOR
SWITCH WRITING TO READING
(e) EXPANDED IMAGE MEMORY IN READ STATE
CONVERT RGB TO CMYK
(f) READING/SUPPLY/CONVERSION
CIDr0
CIDr
PRINT ENGINE
PRINT ENGINE

FIG. 4

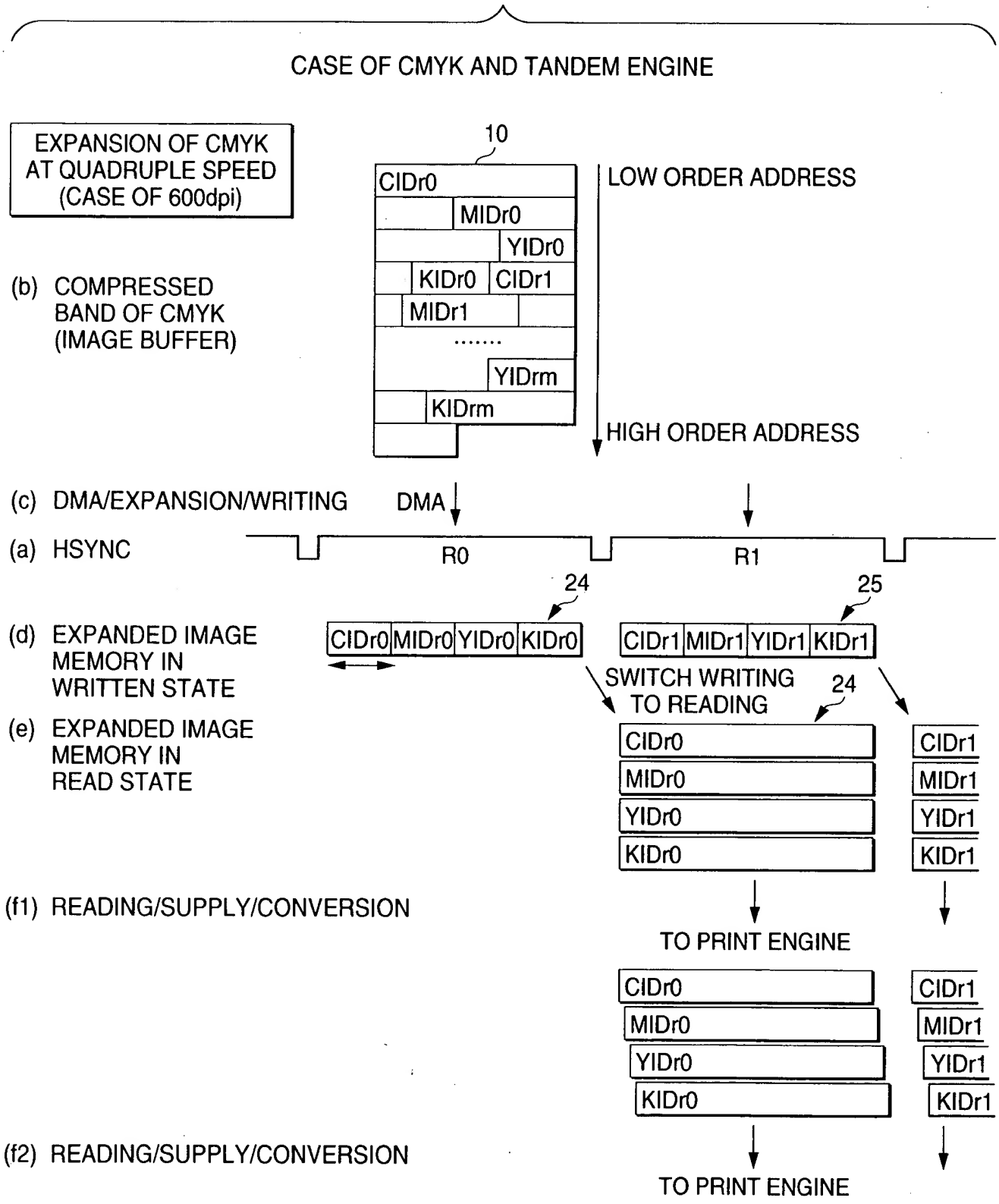

CASE OF CMYK AND TANDEM ENGINE
EXPANSION OF CMYK AT QUADRUPLE SPEED (CASE OF 600dpi)
10
CIDr0
MIDr0
YIDr0
KIDr0
CIDr1
MIDr1
.....
YIDrm
KIDrm
LOW ORDER ADDRESS
HIGH ORDER ADDRESS
(b) COMPRESSED BAND OF CMYK (IMAGE BUFFER)
(c) DMA/EXPANSION/WRITING
DMA
(a) HSYNC
R0
R1
24
25
(d) EXPANDED IMAGE MEMORY IN WRITTEN STATE
CIDr0 MIDr0 YIDr0 KIDr0
CIDr1 MIDr1 YIDr1 KIDr1
SWITCH WRITING TO READING
24
(e) EXPANDED IMAGE MEMORY IN READ STATE
CIDr0
MIDr0
YIDr0
KIDr0
CIDr1
MIDr1
YIDr1
KIDr1
(f1) READING/SUPPLY/CONVERSION
TO PRINT ENGINE
CIDr0
MIDr0
YIDr0
KIDr0
CIDr1
MIDr1
YIDr1
KIDr1
(f2) READING/SUPPLY/CONVERSION
TO PRINT ENGINE

FIG. 5

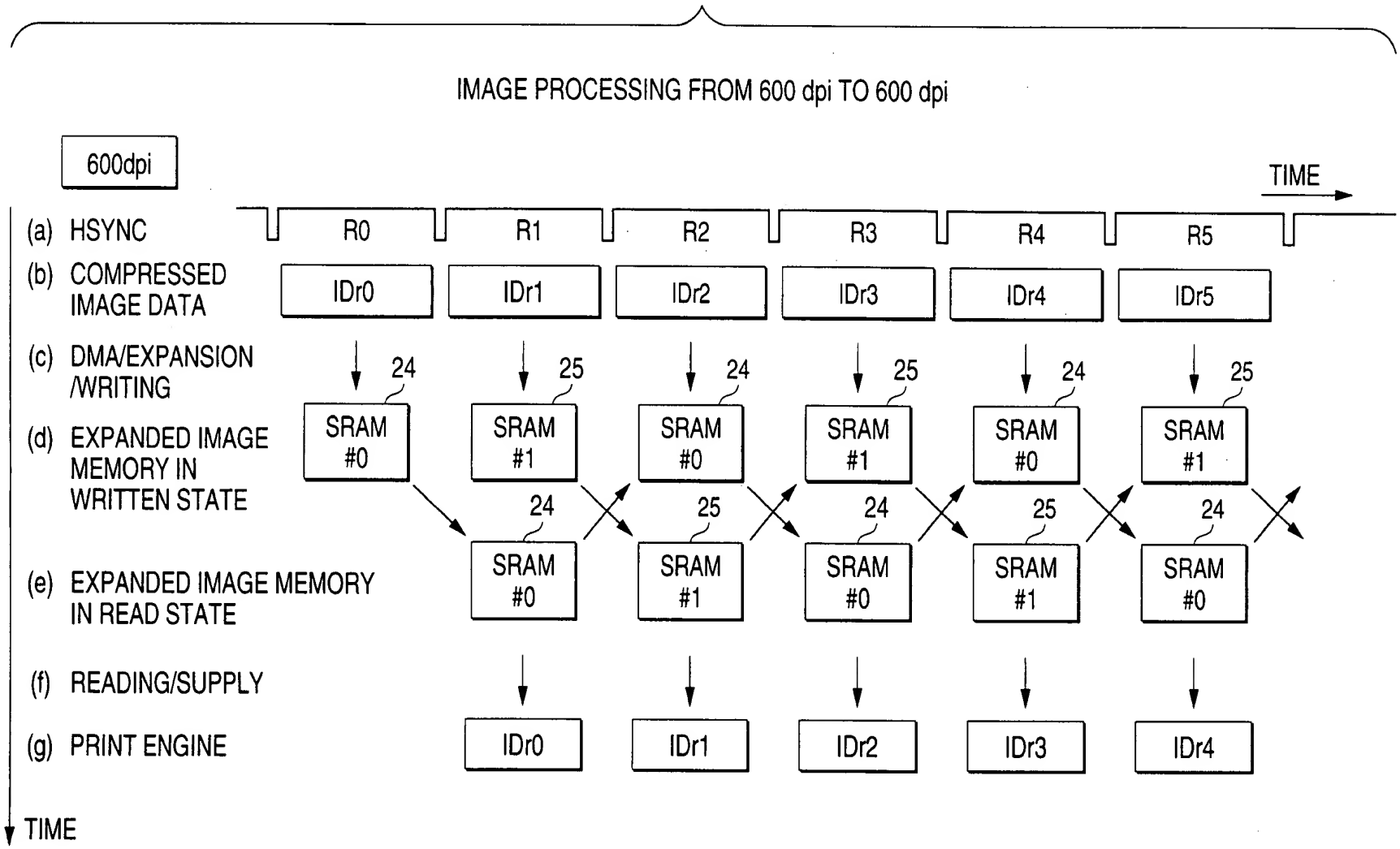


IMAGE PROCESSING FROM 600 dpi TO 600 dpi
600dpi
TIME
(a) HSYNC
R0
R1
R2
R3
R4
R5
(b) COMPRESSED IMAGE DATA
IDr0
IDr1
IDr2
IDr3
IDr4
IDr5
(c) DMA/EXPANSION /WRITING
24
25
(d) EXPANDED IMAGE MEMORY IN WRITTEN STATE
SRAM #0
SRAM #1
(e) EXPANDED IMAGE MEMORY IN READ STATE
(f) READING/SUPPLY
(g) PRINT ENGINE
IDr0
IDr1
IDr2
IDr3
IDr4
TIME

FIG. 6

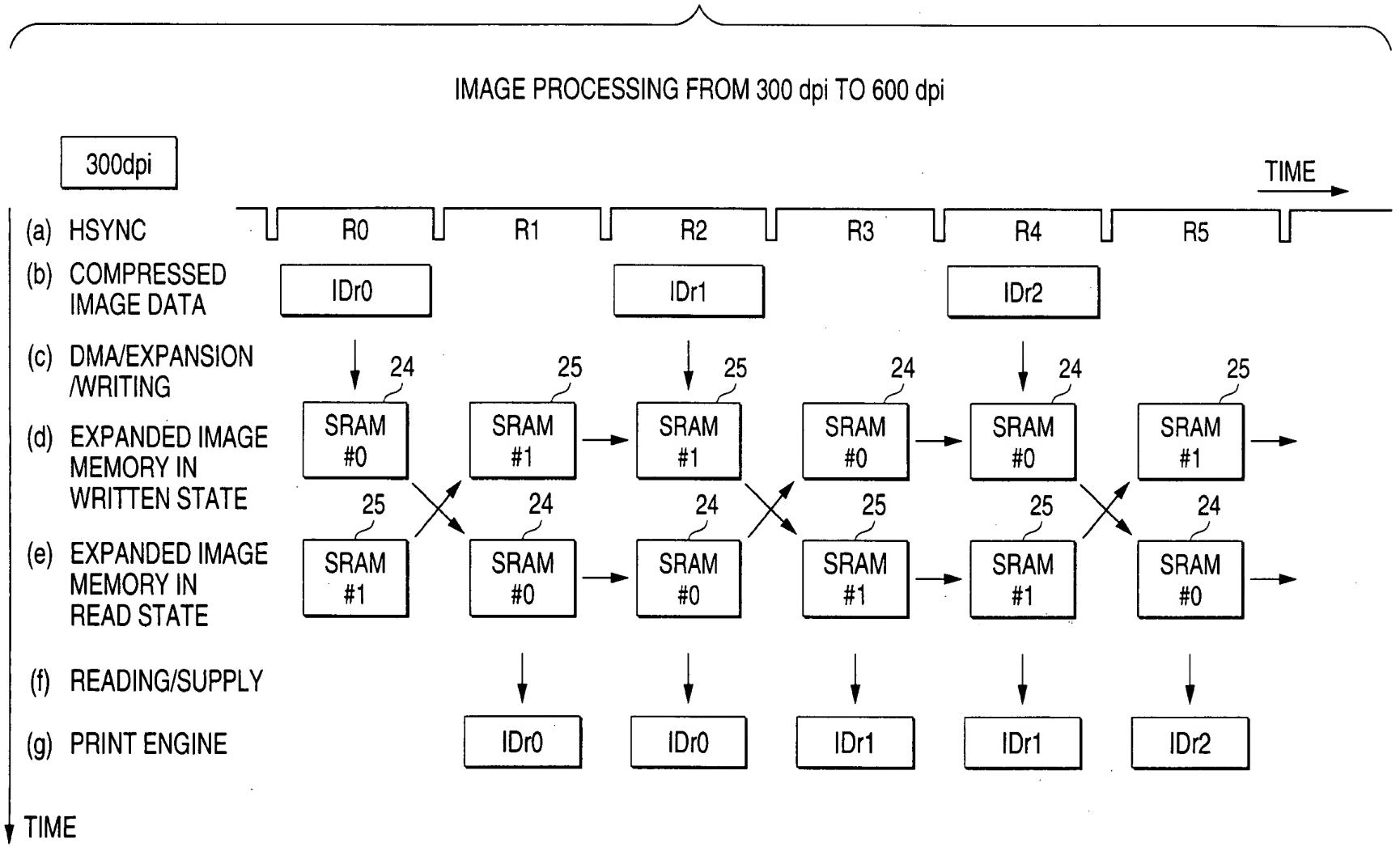


IMAGE PROCESSING FROM 300 dpi TO 600 dpi
300dpi
TIME
(a) HSYNC
R0
R1
R2
R3
R4
R5
(b) COMPRESSED IMAGE DATA
IDr0
IDr1
IDr2
(c) DMA/EXPANSION /WRITING
24
25
(d) EXPANDED IMAGE MEMORY IN WRITTEN STATE
SRAM #0
SRAM #1
(e) EXPANDED IMAGE MEMORY IN READ STATE
(f) READING/SUPPLY
(g) PRINT ENGINE
IDr0
IDr1
IDr2
TIME

FIG. 7

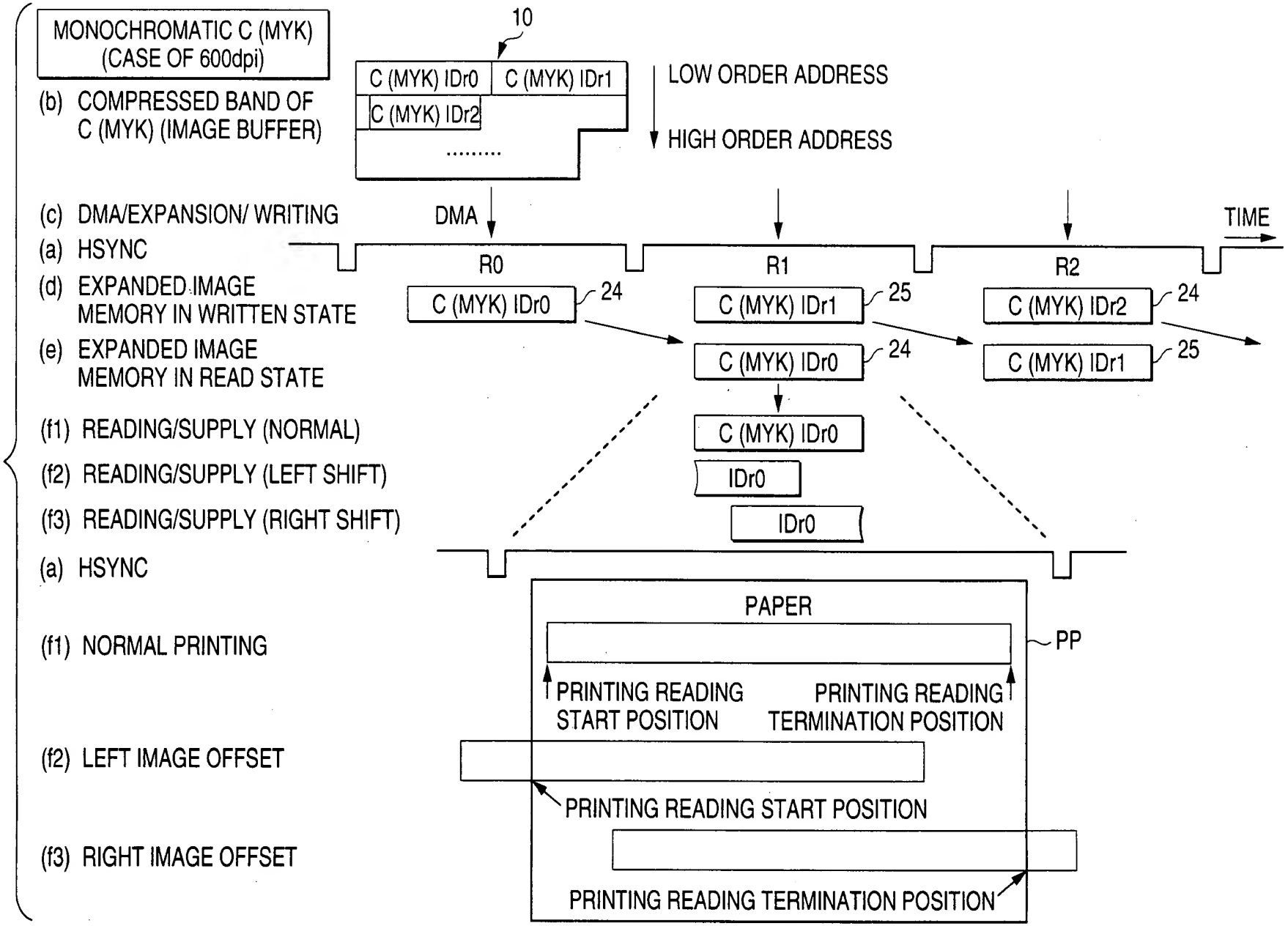

MONOCHROMATIC C (MYK)
(CASE OF 600dpi)
(b) COMPRESSED BAND OF
C (MYK) (IMAGE BUFFER)
10
C (MYK) IDr0
C (MYK) IDr1
C (MYK) IDr2
.....
LOW ORDER ADDRESS
HIGH ORDER ADDRESS
(c) DMA/EXPANSION/ WRITING
DMA
TIME
(a) HSYNC
R0
R1
R2
(d) EXPANDED IMAGE
MEMORY IN WRITTEN STATE
C (MYK) IDr0
24
C (MYK) IDr1
25
C (MYK) IDr2
24
(e) EXPANDED IMAGE
MEMORY IN READ STATE
C (MYK) IDr0
24
C (MYK) IDr1
25
(f1) READING/SUPPLY (NORMAL)
C (MYK) IDr0
(f2) READING/SUPPLY (LEFT SHIFT)
IDr0
(f3) READING/SUPPLY (RIGHT SHIFT)
IDr0
(a) HSYNC
PAPER
(f1) NORMAL PRINTING
PP
PRINTING READING
START POSITION
PRINTING READING
TERMINATION POSITION
(f2) LEFT IMAGE OFFSET
PRINTING READING START POSITION
(f3) RIGHT IMAGE OFFSET
PRINTING READING TERMINATION POSITION

FIG. 8

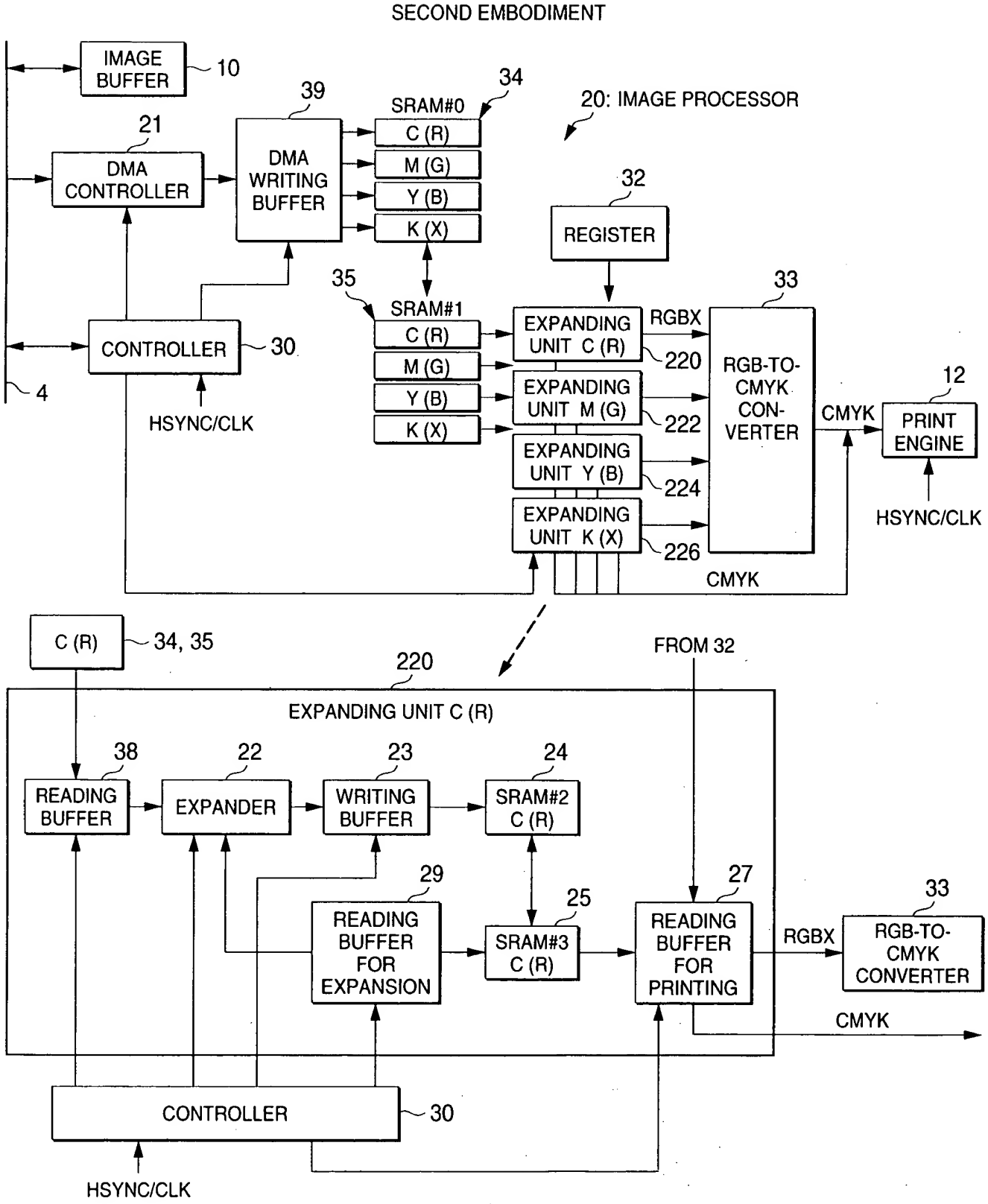

SECOND EMBODIMENT
IMAGE BUFFER
10
39
34
SRAM#0
20: IMAGE PROCESSOR
21
C (R)
M (G)
Y (B)
K (X)
DMA CONTROLLER
DMA WRITING BUFFER
32
REGISTER
35
SRAM#1
33
EXPANDING UNIT C (R)
RGBX
220
RGB-TO-CMYK CON-VERTER
CMYK
12
PRINT ENGINE
EXPANDING UNIT M (G)
222
EXPANDING UNIT Y (B)
224
EXPANDING UNIT K (X)
226
CONTROLLER
30
4
HSYNC/CLK
HSYNC/CLK
CMYK
C (R)
34, 35
220
FROM 32
EXPANDING UNIT C (R)
38
22
23
24
READING BUFFER
EXPANDER
WRITING BUFFER
SRAM#2 C (R)
29
27
33
25
READING BUFFER FOR EXPANSION
SRAM#3 C (R)
READING BUFFER FOR PRINTING
RGBX
RGB-TO-CMYK CONVERTER
CMYK
CONTROLLER
30
HSYNC/CLK

FIG. 9

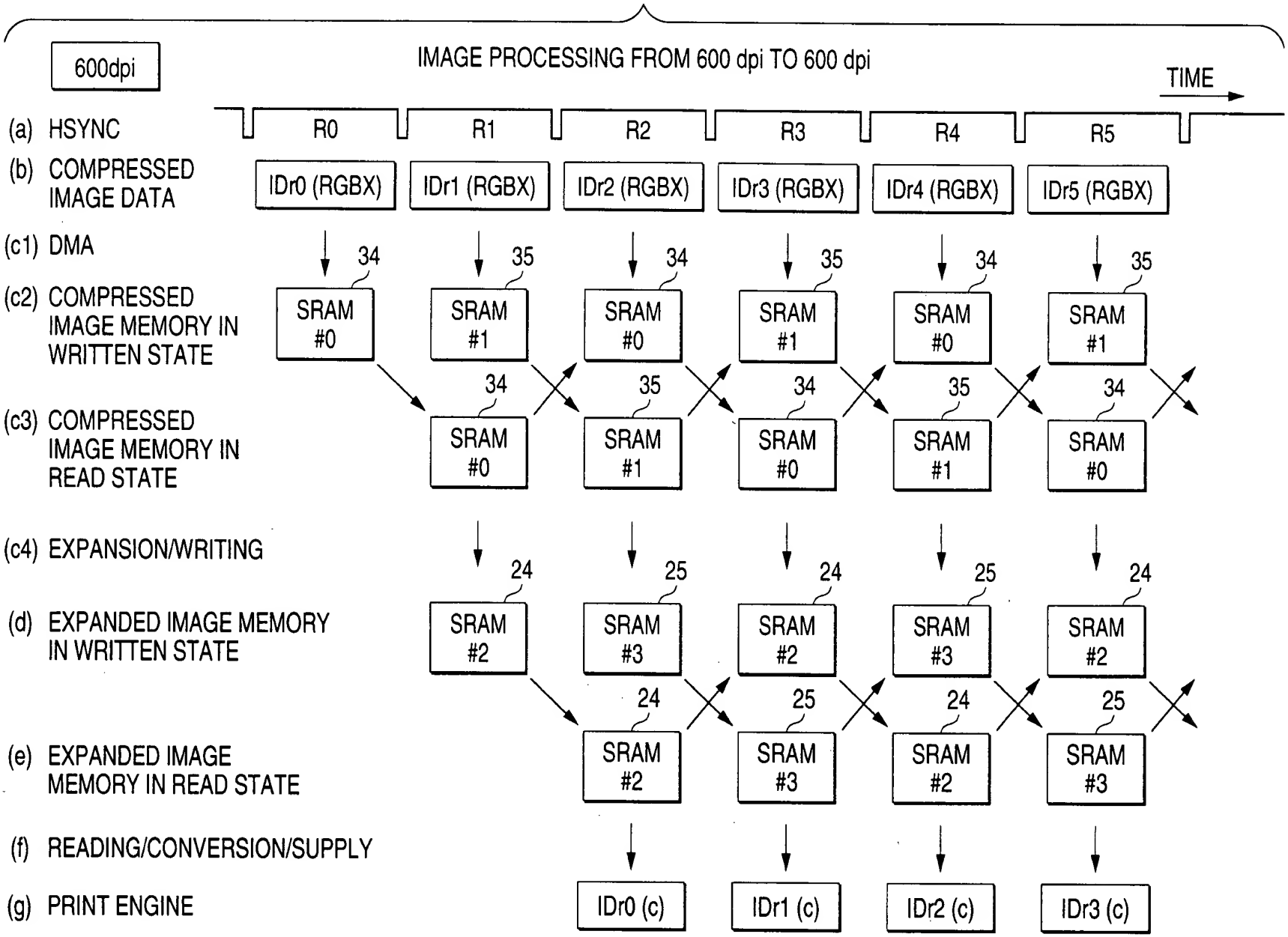

600dpi
IMAGE PROCESSING FROM 600 dpi TO 600 dpi
TIME
(a) HSYNC
R0
R1
R2
R3
R4
R5
(b) COMPRESSED IMAGE DATA
IDr0 (RGBX)
IDr1 (RGBX)
IDr2 (RGBX)
IDr3 (RGBX)
IDr4 (RGBX)
IDr5 (RGBX)
(c1) DMA
(c2) COMPRESSED IMAGE MEMORY IN WRITTEN STATE
(c3) COMPRESSED IMAGE MEMORY IN READ STATE
SRAM #0
SRAM #1
34
35
(c4) EXPANSION/WRITING
(d) EXPANDED IMAGE MEMORY IN WRITTEN STATE
SRAM #2
SRAM #3
24
25
(e) EXPANDED IMAGE MEMORY IN READ STATE
(f) READING/CONVERSION/SUPPLY
(g) PRINT ENGINE
IDr0 (c)
IDr1 (c)
IDr2 (c)
IDr3 (c)

FIG. 10

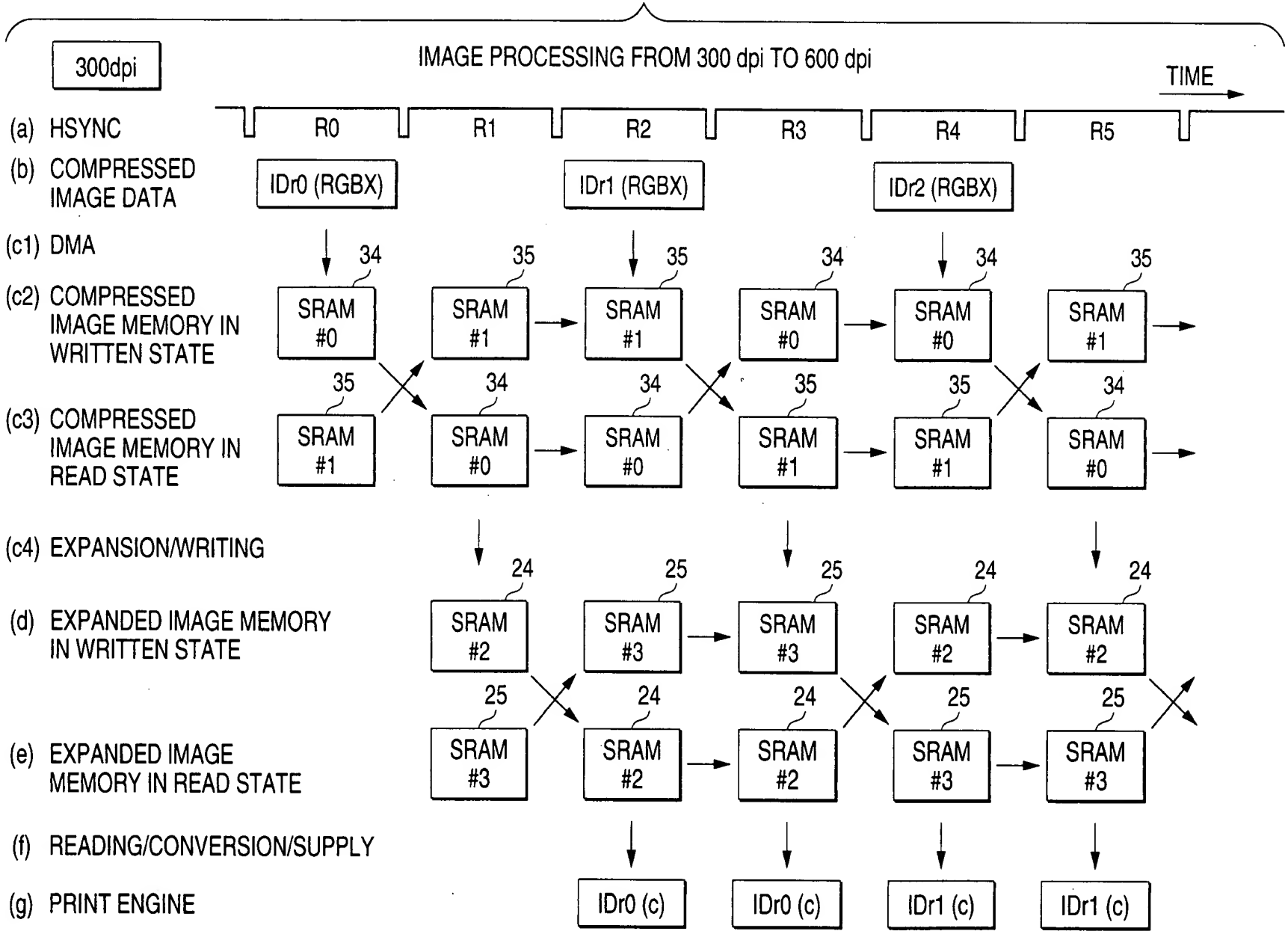

300dpi
IMAGE PROCESSING FROM 300 dpi TO 600 dpi
TIME
(a) HSYNC
R0
R1
R2
R3
R4
R5
(b) COMPRESSED IMAGE DATA
IDr0 (RGBX)
IDr1 (RGBX)
IDr2 (RGBX)
(c1) DMA
(c2) COMPRESSED IMAGE MEMORY IN WRITTEN STATE
(c3) COMPRESSED IMAGE MEMORY IN READ STATE
SRAM #0
SRAM #1
34
35
(c4) EXPANSION/WRITING
(d) EXPANDED IMAGE MEMORY IN WRITTEN STATE
(e) EXPANDED IMAGE MEMORY IN READ STATE
SRAM #2
SRAM #3
24
25
(f) READING/CONVERSION/SUPPLY
(g) PRINT ENGINE
IDr0 (c)
IDr1 (c)

FIG. 11

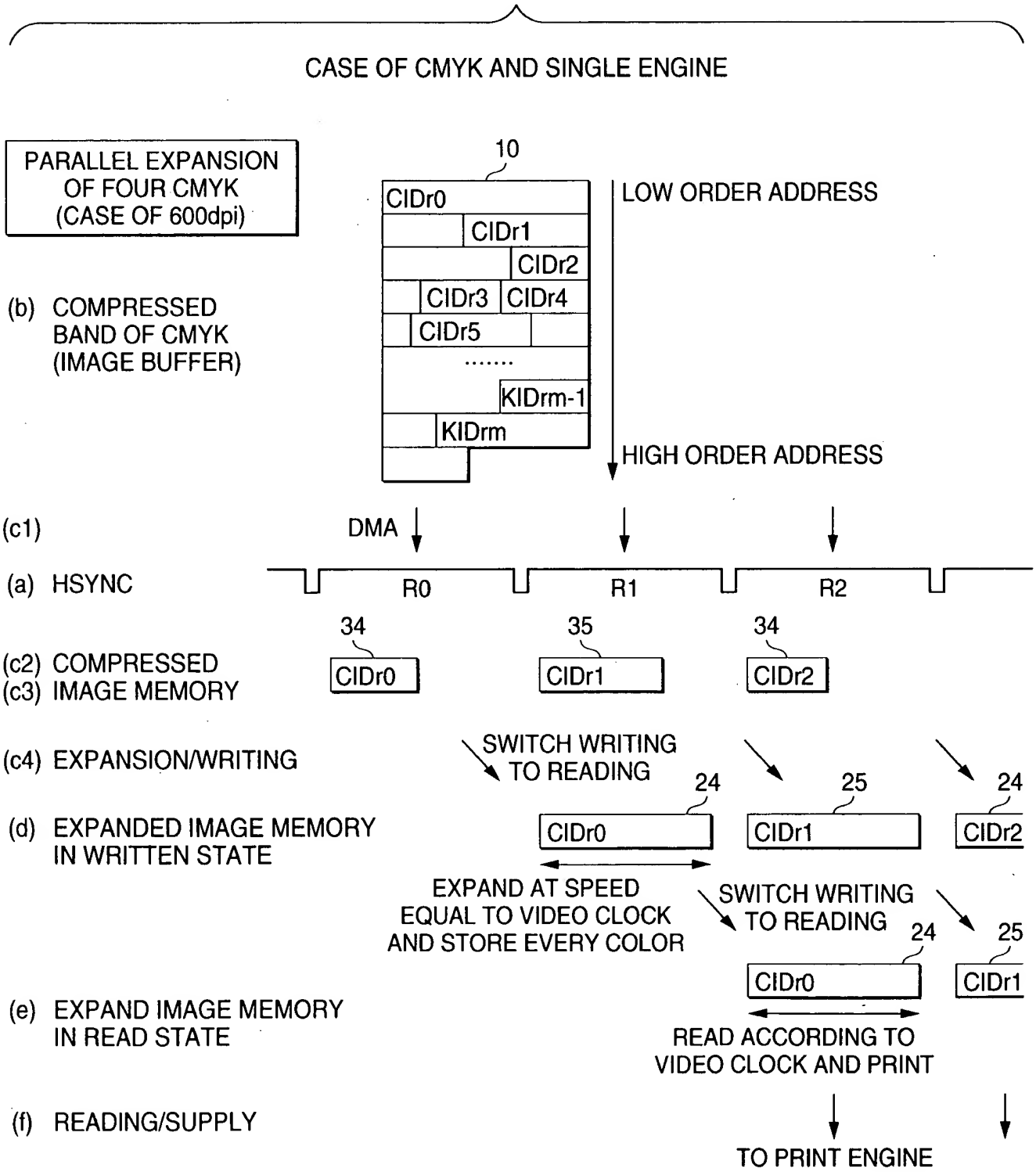

CASE OF CMYK AND SINGLE ENGINE
PARALLEL EXPANSION OF FOUR CMYK (CASE OF 600dpi)
(b) COMPRESSED BAND OF CMYK (IMAGE BUFFER)
10
CIDr0
CIDr1
CIDr2
CIDr3
CIDr4
CIDr5
.....
KIDrm-1
KIDrm
LOW ORDER ADDRESS
HIGH ORDER ADDRESS
(c1)
DMA
(a) HSYNC
R0
R1
R2
34
35
34
(c2) COMPRESSED
(c3) IMAGE MEMORY
CIDr0
CIDr1
CIDr2
(c4) EXPANSION/WRITING
SWITCH WRITING TO READING
24
25
24
(d) EXPANDED IMAGE MEMORY IN WRITTEN STATE
CIDr0
CIDr1
CIDr2
EXPAND AT SPEED EQUAL TO VIDEO CLOCK AND STORE EVERY COLOR
SWITCH WRITING TO READING
24
25
(e) EXPAND IMAGE MEMORY IN READ STATE
CIDr0
CIDr1
READ ACCORDING TO VIDEO CLOCK AND PRINT
(f) READING/SUPPLY
TO PRINT ENGINE

FIG. 12

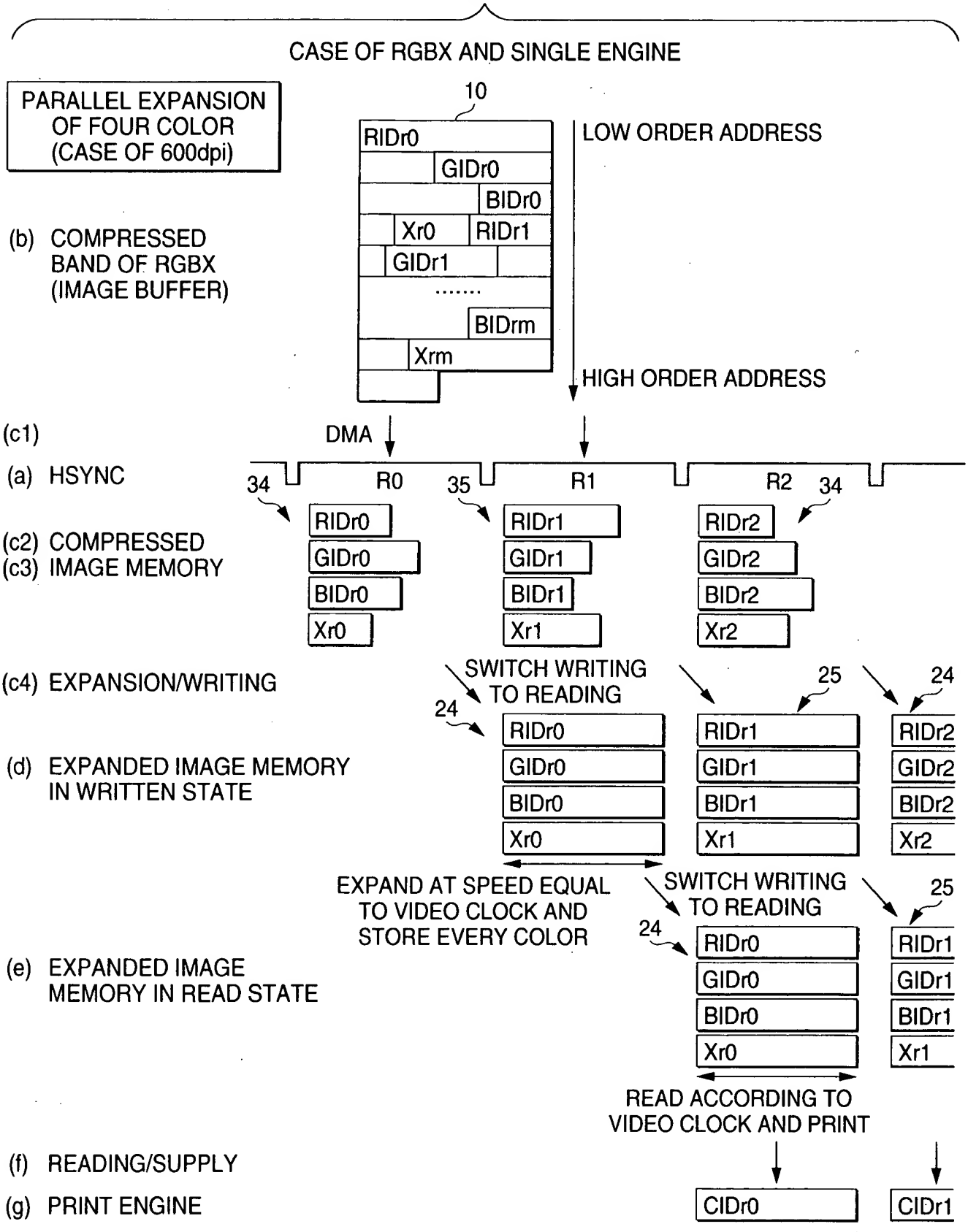
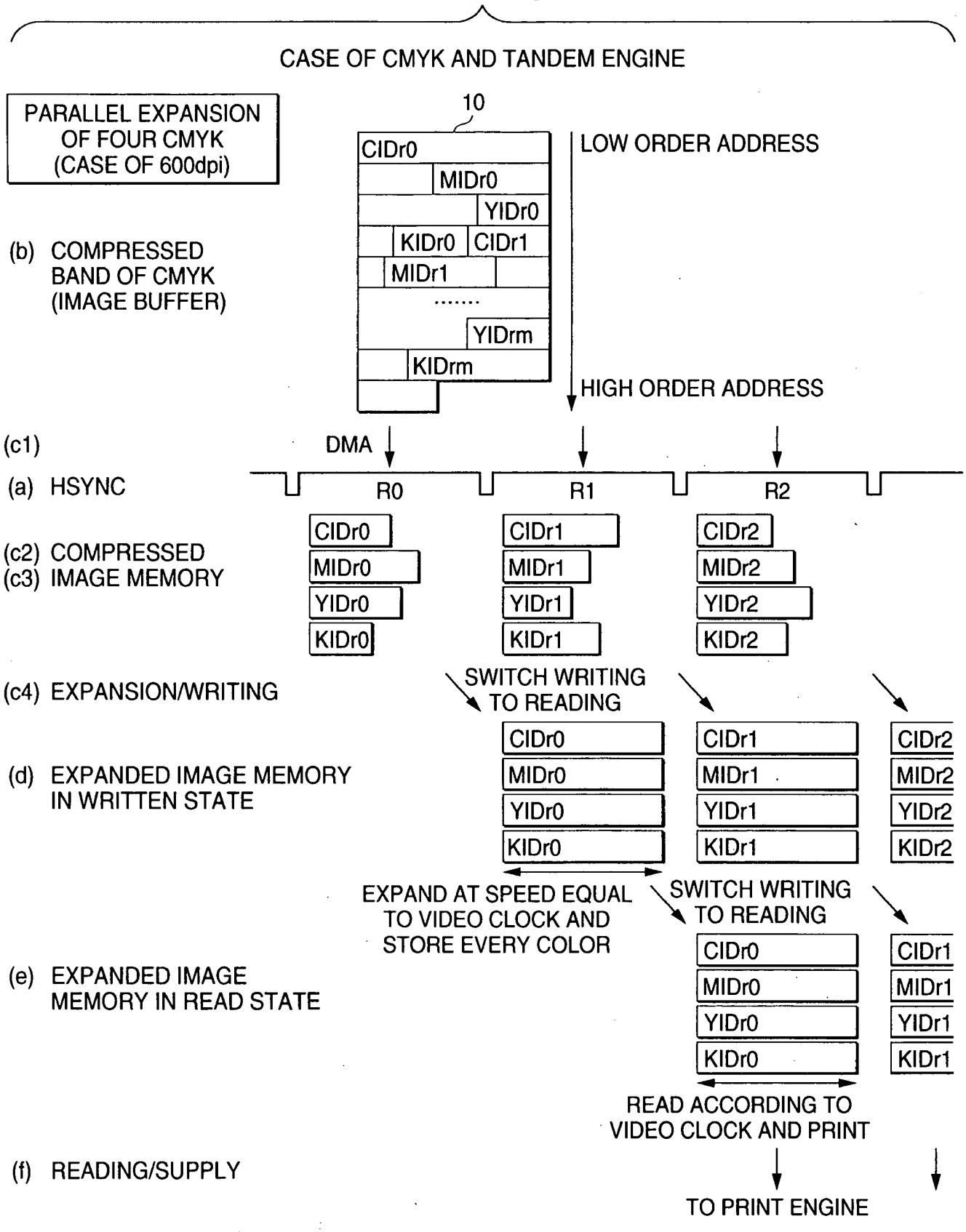

CASE OF RGBX AND SINGLE ENGINE
PARALLEL EXPANSION OF FOUR COLOR (CASE OF 600dpi)
10
RIDr0
GIDr0
BIDr0
Xr0
RIDr1
GIDr1
.....
BIDrm
Xrm
LOW ORDER ADDRESS
HIGH ORDER ADDRESS
(b) COMPRESSED BAND OF RGBX (IMAGE BUFFER)
(c1)
DMA
(a) HSYNC
34
R0
35
R1
R2
34
(c2) COMPRESSED
(c3) IMAGE MEMORY
RIDr0
GIDr0
BIDr0
Xr0
RIDr1
GIDr1
BIDr1
Xr1
RIDr2
GIDr2
BIDr2
Xr2
(c4) EXPANSION/WRITING
SWITCH WRITING TO READING
24
25
24
(d) EXPANDED IMAGE MEMORY IN WRITTEN STATE
RIDr0
GIDr0
BIDr0
Xr0
RIDr1
GIDr1
BIDr1
Xr1
RIDr2
GIDr2
BIDr2
Xr2
EXPAND AT SPEED EQUAL TO VIDEO CLOCK AND STORE EVERY COLOR
SWITCH WRITING TO READING
24
25
(e) EXPANDED IMAGE MEMORY IN READ STATE
RIDr0
GIDr0
BIDr0
Xr0
RIDr1
GIDr1
BIDr1
Xr1
READ ACCORDING TO VIDEO CLOCK AND PRINT
(f) READING/SUPPLY
(g) PRINT ENGINE
CIDr0
CIDr1

FIG. 13


CASE OF CMYK AND TANDEM ENGINE
PARALLEL EXPANSION OF FOUR CMYK (CASE OF 600dpi)
10
CIDr0
MIDr0
YIDr0
KIDr0
CIDr1
MIDr1
.....
YIDrm
KIDrm
LOW ORDER ADDRESS
HIGH ORDER ADDRESS
(b) COMPRESSED BAND OF CMYK (IMAGE BUFFER)
(c1)
DMA
(a) HSYNC
R0
R1
R2
(c2) COMPRESSED
(c3) IMAGE MEMORY
CIDr0
MIDr0
YIDr0
KIDr0
CIDr1
MIDr1
YIDr1
KIDr1
CIDr2
MIDr2
YIDr2
KIDr2
(c4) EXPANSION/WRITING
SWITCH WRITING TO READING
(d) EXPANDED IMAGE MEMORY IN WRITTEN STATE
EXPAND AT SPEED EQUAL TO VIDEO CLOCK AND STORE EVERY COLOR
SWITCH WRITING TO READING
(e) EXPANDED IMAGE MEMORY IN READ STATE
READ ACCORDING TO VIDEO CLOCK AND PRINT
(f) READING/SUPPLY
TO PRINT ENGINE